



REGTECH AND SUPTECH ADOPTION IN THE FINANCIAL REGULATORY ECOSYSTEM: AN INTEGRATED CONCEPTUAL FRAMEWORK

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Abstract. The increasing digitalization of financial regulation has accelerated the adoption of Regulatory Technology (RegTech) and Supervisory Technology (SupTech). However, existing studies typically examine these technologies independently, overlooking their interconnected roles within the financial regulatory ecosystem. This study develops an integrated conceptual framework based on the synthesis of existing literature to identify the common drivers and barriers influencing RegTech and SupTech adoption. The framework highlights the interaction between commercial banks and central banks and demonstrates that technology adoption is shaped by enabling and constraining forces operating across the regulatory ecosystem. The framework provides a foundation for future empirical research and policy development.

Keywords: RegTech, SupTech, financial regulation, technology adoption, conceptual framework, digital transformation, financial regulatory ecosystem.

MOLIYAVIY TARTIBGA SOLISH EKOTIZIMIDA REGTECH VA SUPTECH JORIY ETILISHI: INTEGRATSIYALASHGAN KONSEPTUAL MODEL

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Annotatsiya. Moliyaviy tartibga solishning raqamlashtirilishi Regulatory Technology (RegTech) va Supervisory Technology (SupTech) texnologiyalarining joriy etilishini jadallashtirdi. Biroq, mavjud tadqiqotlarda ushbu texnologiyalar odatda alohida o'rganilib, ularning moliyaviy tartibga solish ekotizimidagi o'zaro bog'liqligiga yetarli e'tibor qaratilmagan. Ushbu tadqiqot mavjud adabiyotlarni tahlil qilish va umumlashtirish asosida RegTech va SupTech joriy etilishiga ta'sir etuvchi umumiy rag'batlantiruvchi hamda cheklovchi omillarni aniqlovchi integratsiyalashgan konseptual modelni ishlab chiqadi. Model tijorat banklari va markaziy banklar o'rtasidagi o'zaro munosabatlarni yoritib, texnologiyalarni joriy etish tartibga solish ekotizimida amal qiluvchi rag'batlantiruvchi va cheklovchi omillar muvozanati bilan belgilanishini ko'rsatadi. Taklif etilgan model kelgusidagi empirik tadqiqotlar va siyosatni ishlab chiqish uchun nazariy asos bo'lib xizmat qiladi.

Kalit so'zlar: RegTech, SupTech, moliyaviy tartibga solish, texnologiyalarni joriy etish, konseptual model, raqamli transformatsiya, moliyaviy tartibga solish ekotizimi.

ВНЕДРЕНИЕ REGTECH И SUPTECH В ЭКОСИСТЕМЕ ФИНАНСОВОГО РЕГУЛИРОВАНИЯ: ИНТЕГРИРОВАННАЯ КОНЦЕПТУАЛЬНАЯ МОДЕЛЬ

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Аннотация. Усиление цифровизации финансового регулирования ускорило внедрение технологий Regulatory Technology (RegTech) и Supervisory Technology (SupTech). Однако существующие исследования, как правило, рассматривают эти технологии отдельно, не учитывая их взаимосвязанную роль в экосистеме финансового регулирования. В данной работе разработана интегрированная концептуальная модель на основе анализа и синтеза существующей литературы, позволяющая выявить общие движущие силы и сдерживающие факторы внедрения RegTech и SupTech. Модель отражает взаимодействие коммерческих банков и центральных банков и показывает, что внедрение технологий определяется совокупностью стимулирующих и ограничивающих факторов, действующих в рамках финансовой регуляторной экосистемы. Предложенная модель служит основой для дальнейших эмпирических исследований и разработки регуляторной политики.

Ключевые слова: RegTech, SupTech, финансовое регулирование, внедрение технологий, концептуальная модель, цифровая трансформация, экосистема финансового регулирования.

Introduction.

The increasing complexity of financial regulation, growing volumes of regulatory data, and rapid digital transformation of the financial sector have created significant challenges for both financial institutions and supervisory authorities (Arner et al., 2017; Dziawgo, 2021; Monkiewicz & Monkiewicz, 2022). Following the Global Financial Crisis (GFC), regulatory requirements expanded considerably, resulting in more frequent, granular, and data-intensive reporting obligations for banks (Arner et al., 2017). At the same time, supervisory authorities have faced increasing pressure to monitor financial institutions effectively, identify emerging risks, and maintain financial stability in an increasingly interconnected and technology-driven financial environment (Dziawgo, 2021; Ababii, 2024).

In response to these challenges, Regulatory Technology (RegTech) and Supervisory Technology (SupTech) have emerged as important components of modern financial regulation (Arner et al., 2017; McCarthy, 2023). RegTech refers to the application of technological solutions to facilitate regulatory compliance, reporting, risk management, and monitoring within financial institutions, while SupTech encompasses the use of technology by supervisory authorities to improve regulatory oversight, data collection, risk assessment, and supervisory decision-making (Arner et al., 2017; Dziawgo, 2021). Together, these technologies support the digital transformation of financial regulation by enhancing efficiency, reducing operational burdens, and enabling more data-driven approaches to regulation and supervision (Monkiewicz & Monkiewicz, 2022; Ababii, 2024).

Existing literature highlights numerous benefits associated with RegTech and SupTech adoption. RegTech has been shown to improve compliance effectiveness, reduce operational costs, automate regulatory reporting, and strengthen risk management processes (Hamdan et al., 2020; Jeyasingh, 2023; Zabat et al., 2024). Similarly, SupTech enables supervisory authorities to automate data collection, enhance supervisory analytics, improve early risk

detection, and support more proactive supervisory interventions (Dziawgo, 2021; Guerra et al., 2022; Degryse et al., 2025). Consequently, both technologies are increasingly viewed as essential instruments for improving the effectiveness and efficiency of contemporary financial regulation (McCarthy, 2023; Abikoye et al., 2024).

Despite these potential benefits, the adoption of RegTech and SupTech remains uneven across institutions and jurisdictions. Previous studies identify numerous factors that facilitate or impede adoption, including increasing regulatory complexity, technological advancement, data availability, implementation costs, legacy information systems, data governance challenges, cybersecurity concerns, organizational capabilities, and shortages of specialized skills (Arner et al., 2017; Papantoniou, 2022; McCarthy, 2023; Abikoye et al., 2024). Notably, many of these drivers and barriers appear consistently across both RegTech and SupTech literature.

While research on RegTech and SupTech has expanded significantly in recent years, existing studies have largely examined these technologies as separate phenomena. The literature predominantly focuses either on RegTech adoption by financial institutions or on SupTech implementation by supervisory authorities (Dziawgo, 2021; McCarthy, 2023; Ababii, 2024). Such an approach overlooks the inherently interconnected nature of the regulatory ecosystem, where regulators and regulated institutions continuously exchange information, adapt to common regulatory requirements, and respond to each other's technological developments (Arner et al., 2017). Consequently, many of the factors influencing adoption may operate at the ecosystem level rather than at the organizational level.

This observation suggests the need for a broader perspective that conceptualizes RegTech and SupTech as interdependent components of a shared regulatory ecosystem. Understanding adoption through this lens may provide a more comprehensive explanation of how technological, organizational, regulatory, and governance-related forces shape digital transformation across the financial regulatory landscape.

Accordingly, this paper develops a conceptual framework that maps the common drivers and barriers influencing RegTech and SupTech adoption within the regulatory relationship between central banks and commercial banks. By synthesizing insights from the existing literature, the study identifies the systemic forces shaping technology adoption on both sides of the regulatory ecosystem and illustrates how these forces collectively influence the effectiveness of digital regulatory transformation. In doing so, the paper contributes to the growing RegTech and SupTech literature by shifting the focus from individual organizations to the broader regulatory ecosystem in which these technologies evolve and interact.

Literature Review.

RegTech and SupTech in the financial regulatory ecosystem

The increasing complexity of financial regulation and the growing volume of regulatory data have accelerated the adoption of technological solutions within the financial sector. In this context, Regulatory Technology (RegTech) and Supervisory Technology (SupTech) have emerged as complementary approaches to enhancing regulatory compliance and supervisory effectiveness (Arner et al., 2017; Dziawgo, 2021).

RegTech refers to the use of technology by regulated institutions to facilitate compliance with regulatory requirements, automate reporting processes, strengthen risk management, and improve operational efficiency (Arner et al., 2017). SupTech, on the other hand, refers to the application of technological tools by supervisory authorities to improve data collection, risk assessment, market surveillance, and supervisory decision-making (Dziawgo, 2021; Monkiewicz & Monkiewicz, 2022).

Although RegTech and SupTech are often examined separately, they represent two interconnected components of the same regulatory ecosystem. Commercial banks and supervisory authorities continuously exchange information and interact through reporting,

monitoring, and supervisory processes. Consequently, technological developments on one side of the regulatory relationship frequently influence adoption decisions on the other side (Arner et al., 2017; McCarthy, 2023).

Existing literature identifies several technologies supporting RegTech and SupTech implementation, including artificial intelligence, machine learning, natural language processing, big data analytics, cloud computing, application programming interfaces (APIs), blockchain, and robotic process automation (Abikoye et al., 2024; Ababii, 2024). These technologies enable more efficient processing of large volumes of regulatory data and facilitate more proactive approaches to compliance and supervision.

Drivers of RegTech and SupTech adoption

The literature identifies multiple factors motivating the adoption of RegTech and SupTech solutions. One of the most frequently cited drivers is increasing regulatory complexity. Following the Global Financial Crisis, financial institutions have faced expanding reporting requirements and heightened compliance obligations, creating demand for more efficient compliance management systems (Arner et al., 2017; McCarthy, 2023).

The growing volume, velocity, and variety of financial data also serve as a major driver of technology adoption. Traditional manual approaches are increasingly unable to process the scale of information generated by modern financial systems, encouraging both banks and regulators to adopt advanced analytical tools (Dziawgo, 2021; Monkiewicz & Monkiewicz, 2022).

Operational efficiency and cost reduction constitute another significant adoption driver. RegTech solutions enable automation of repetitive compliance tasks, reduce reporting burdens, and improve the accuracy of regulatory submissions. Similarly, SupTech solutions allow supervisory authorities to automate data collection and analysis, reducing resource requirements while increasing supervisory coverage (Hamdan et al., 2020; Ababii, 2024).

The literature also highlights improved risk management capabilities as a key motivation for adoption. Advanced analytical tools support the identification of emerging risks, facilitate early warning systems, and strengthen monitoring processes for both financial institutions and regulators (Guerra et al., 2022; Degryse et al., 2025). Technological advancement, particularly in artificial intelligence and data analytics, further expands the potential applications and benefits of RegTech and SupTech solutions (Abikoye et al., 2024).

Barriers to RegTech and SupTech adoption

Despite their potential benefits, RegTech and SupTech implementation faces numerous challenges. One of the most commonly cited barriers is the prevalence of legacy information systems. Many financial institutions and supervisory authorities continue to rely on outdated technological infrastructures that limit interoperability and complicate the integration of modern digital solutions (Papantoniou, 2022; McCarthy, 2023).

Data-related challenges represent another significant obstacle. Effective RegTech and SupTech solutions depend on the availability of accurate, standardized, and high-quality data. Poor data quality, fragmented information systems, and difficulties in data integration may substantially reduce the effectiveness of technological solutions (Monkiewicz & Monkiewicz, 2022; Abikoye et al., 2024).

Implementation costs also remain a considerable concern, particularly for smaller institutions with limited financial and technological resources. The acquisition, customization, and maintenance of advanced technological systems often require substantial investment, which may delay adoption decisions (McCarthy, 2023).

A recurring challenge identified across the literature is the shortage of specialized skills and technological expertise. Successful implementation requires competencies in data analytics, information technology, cybersecurity, and advanced digital tools, which are often

scarce among both regulated institutions and supervisory authorities (Dziawgo, 2021; McCarthy, 2023).

Finally, governance-related concerns such as cybersecurity risks, data privacy issues, model transparency, and explainability continue to hinder adoption. As regulatory and supervisory processes become increasingly dependent on technology, concerns regarding accountability, reliability, and operational resilience become more prominent (McCarthy, 2023; Jeyasingh, 2023).

Research gap and conceptual framework development

The review of the literature reveals that RegTech and SupTech adoption are influenced by a remarkably similar set of drivers and barriers. Regulatory complexity, increasing data volumes, operational efficiency, and risk management objectives motivate adoption on both sides of the regulatory relationship, while legacy systems, data challenges, implementation costs, skills shortages, and governance concerns constrain adoption among both regulators and regulated institutions.

However, existing studies largely examine RegTech and SupTech independently, focusing either on commercial banks or supervisory authorities. Limited attention has been devoted to understanding how these common factors operate simultaneously across the regulatory ecosystem. Consequently, there remains a lack of integrative frameworks explaining technology adoption within the broader regulatory relationship between central banks and commercial banks.

To address this gap, the present study develops a conceptual framework that synthesizes the common drivers and barriers identified in the literature and maps their influence on RegTech and SupTech adoption within the financial regulatory ecosystem.

Research methodology.

This study adopts a conceptual framework development approach based on the analysis and synthesis of existing literature on Regulatory Technology (RegTech) and Supervisory Technology (SupTech). Conceptual framework development is appropriate when the objective of research is to integrate fragmented knowledge, identify recurring patterns across existing studies, and provide a structured representation of relationships among key concepts (Jabareen, 2009).

The framework development process involved the identification, comparison, and synthesis of factors influencing the adoption of RegTech and SupTech solutions. Existing research on digital transformation in financial regulation, technology-enabled compliance, and supervisory innovation was examined to identify recurring themes related to adoption motivations and implementation challenges.

The analysis focused on two main dimensions: (1) drivers that encourage RegTech and SupTech adoption and (2) barriers that constrain their implementation. Factors were included in the framework when they were repeatedly identified in previous studies as influencing the implementation or adoption of regulatory and supervisory technologies. The identified factors were then grouped into broader conceptual categories based on similarities and their relevance to the financial regulatory ecosystem.

The synthesis of the literature revealed that many adoption drivers and barriers are common across both RegTech and SupTech domains. For example, increasing regulatory complexity, growing data requirements, operational efficiency objectives, and improved risk management capabilities motivate adoption among both regulated institutions and supervisory authorities. Similarly, challenges related to legacy systems, data quality, implementation costs, skills shortages, and governance concerns constrain technology adoption across the regulatory ecosystem.

Based on these findings, the identified factors were organized into a conceptual framework illustrating the relationship between RegTech and SupTech adoption drivers,

adoption barriers, and the broader financial regulatory ecosystem. The framework positions RegTech and SupTech as interconnected components rather than separate technological developments, recognizing the continuous interaction between commercial banks, supervisory authorities, and supporting technological infrastructure.

Analysis and discussion of results.

The proposed conceptual framework provides an integrated perspective on the factors influencing the adoption of Regulatory Technology (RegTech) and Supervisory Technology (SupTech) within the financial regulatory ecosystem (see Figure 1). The framework conceptualizes technology adoption as the outcome of the interaction between driving forces that encourage adoption and restraining forces that hinder implementation. At the center of the framework is the continuous relationship between commercial banks and central banks, reflecting the interconnected nature of regulatory compliance and financial supervision.

Unlike existing studies that examine RegTech and SupTech separately, the framework recognizes that technology adoption occurs within a shared ecosystem in which regulated institutions and supervisory authorities continuously exchange information, comply with reporting requirements, and participate in supervisory processes. Consequently, factors affecting technology adoption on one side of the ecosystem often influence adoption decisions on the other side.

The right side of the framework represents the driving forces of RegTech and SupTech adoption. One of the most significant drivers is increasing regulatory complexity and growing volumes of regulatory data. As financial regulations become more extensive and data-intensive, both banks and supervisory authorities face increasing pressure to adopt technological solutions capable of managing compliance and supervisory activities more effectively. The pursuit of operational efficiency and cost reduction further encourages adoption by enabling the automation of repetitive processes, reducing manual workloads, and improving the accuracy of reporting and monitoring activities.

Another important driver is the growing need for proactive risk management. Advanced technological solutions allow both regulators and regulated institutions to identify emerging risks more effectively, strengthen monitoring capabilities, and support earlier intervention when potential issues are detected. Technological advancement also serves as a major enabling factor, as developments in artificial intelligence, machine learning, big data analytics, cloud computing, application programming interfaces, and process automation continuously expand the capabilities and accessibility of RegTech and SupTech solutions.

The left side of the framework represents the restraining forces that limit adoption. Legacy systems remain one of the most significant barriers, as many financial institutions and supervisory authorities continue to operate on outdated technological infrastructures that are difficult to integrate with modern digital solutions. Data-related challenges, including concerns regarding data quality, security, and privacy, further complicate implementation efforts and may reduce the effectiveness of technological systems.

The framework also identifies high implementation costs as an important constraint. The acquisition, customization, integration, and maintenance of advanced technological solutions often require substantial financial resources, particularly for smaller institutions. Talent shortages constitute another significant challenge, as successful implementation requires expertise in information technology, data analytics, cybersecurity, and digital transformation. In addition, concerns regarding model opacity and governance gaps may create uncertainty regarding accountability, transparency, and the reliability of technology-driven processes. Finally, cultural resistance may impede adoption when organizational members are reluctant to modify established procedures or place trust in technology-enabled decision-making processes.

The framework suggests that the extent of RegTech and SupTech adoption depends on the balance between these opposing forces. Strong driving forces increase the incentive to adopt technology, while strong restraining forces slow or inhibit implementation efforts. Because these forces operate across both commercial banks and central banks, technology adoption should be viewed as an ecosystem-level phenomenon rather than as an isolated organizational decision.

By integrating common drivers and barriers identified in the literature, the framework contributes to a more holistic understanding of digital transformation within financial regulation and supervision. It provides a foundation for future empirical studies examining how different factors influence RegTech and SupTech adoption across various regulatory and institutional contexts.

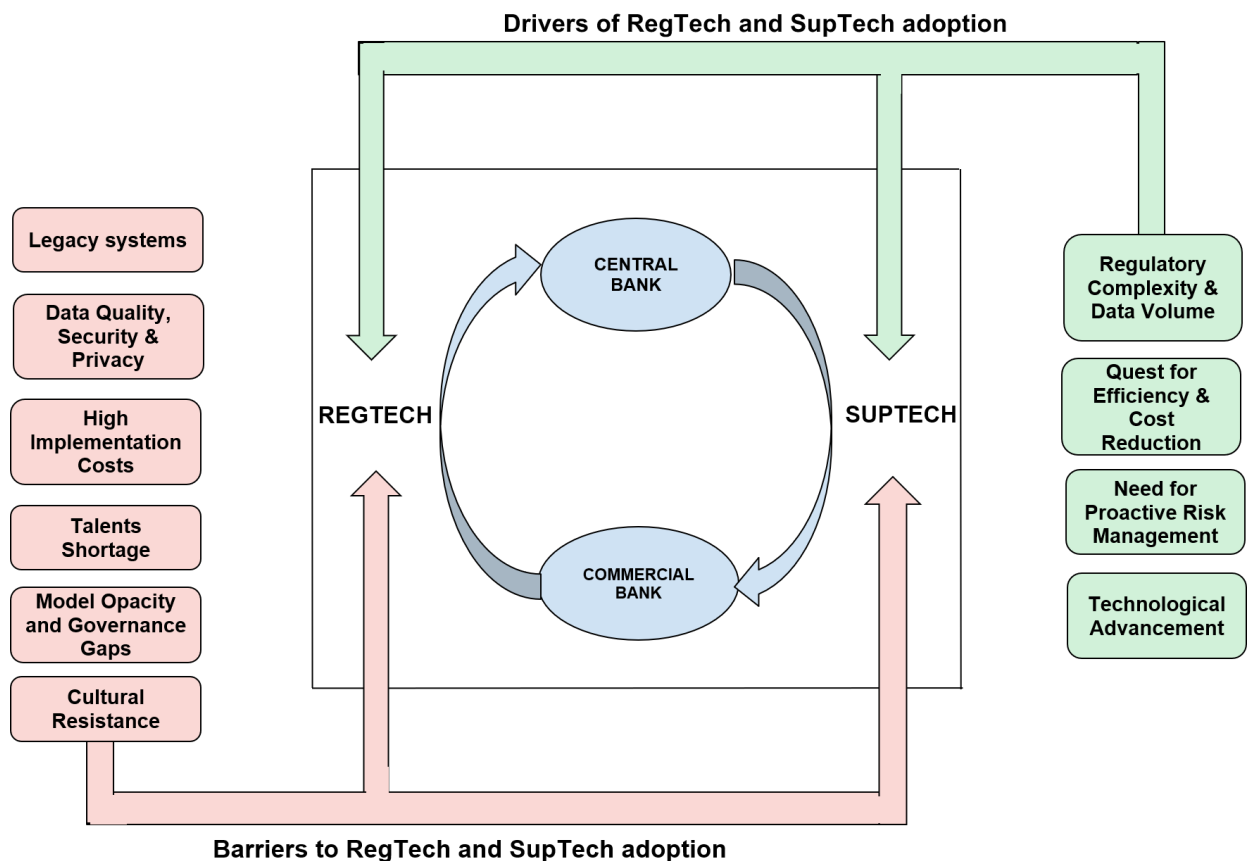


Figure 1. Forces that drive and hinder RegTech and SupTech adoption within the financial regulatory ecosystem.

The proposed conceptual framework contributes to the growing body of research on digital transformation in financial regulation by providing an integrated perspective on RegTech and SupTech adoption. While previous studies have predominantly examined these technologies from the perspective of either regulated institutions or supervisory authorities (Arner et al., 2017; Dziawgo, 2021; McCarthy, 2023), the present framework emphasizes their interdependence within a shared financial regulatory ecosystem. This ecosystem perspective suggests that technology adoption is not solely an organizational decision but is influenced by continuous interactions between commercial banks, central banks, regulatory requirements, and technological capabilities.

One of the principal contributions of the framework is the identification of common drivers and barriers influencing both RegTech and SupTech adoption. The literature consistently demonstrates that increasing regulatory complexity, growing data volumes, operational efficiency objectives, enhanced risk management, and technological advancement

encourage digital transformation among both regulated institutions and supervisory authorities (Arner et al., 2017; Hamdan et al., 2020; Guerra et al., 2022; Degryse et al., 2025). Likewise, legacy systems, data-related challenges, implementation costs, shortages of specialized expertise, governance concerns, and organizational resistance continue to constrain adoption across both groups (Papantoniou, 2022; McCarthy, 2023; Abikoye et al., 2024). By integrating these common factors into a single framework, the study offers a more holistic understanding of technology adoption than approaches that consider RegTech and SupTech independently.

The framework also suggests that successful digital transformation within financial regulation depends on coordination across the regulatory ecosystem. Technological progress achieved by supervisory authorities may be constrained if commercial banks lack the capabilities to generate high-quality regulatory data or implement compatible technological solutions. Similarly, investments in RegTech by financial institutions may not fully realize their potential without corresponding advances in supervisory technologies and supervisory practices. Consequently, effective digital transformation requires complementary technological development, data standardization, and ongoing collaboration between regulators and regulated institutions.

From a practical perspective, the framework provides guidance for both policymakers and financial institutions. For supervisory authorities, the framework highlights the importance of promoting technological readiness across the financial sector while developing regulatory approaches that facilitate innovation without compromising financial stability. For commercial banks, the framework emphasizes that technology adoption should extend beyond regulatory compliance and become part of broader organizational digital transformation strategies involving investments in technological infrastructure, data quality, governance, and workforce capabilities.

The framework also establishes a foundation for future empirical research. Although the present study identifies common drivers and barriers through literature synthesis, the relative importance of these factors is likely to vary across jurisdictions, regulatory environments, institutional characteristics, and levels of technological maturity. Future research may empirically validate the proposed framework using quantitative or qualitative approaches, examine the relationships among the identified constructs, and compare RegTech and SupTech adoption across different countries and financial systems.

Overall, the proposed framework advances understanding of RegTech and SupTech adoption by positioning digital regulatory transformation as an ecosystem-level phenomenon rather than a collection of isolated organizational initiatives. By integrating common adoption drivers and barriers within a single conceptual model, the framework offers a foundation for future research while providing practical insights for regulators and financial institutions seeking to accelerate digital transformation within the financial regulatory ecosystem.

Conclusion and recommendations.

This study developed a conceptual framework explaining the adoption of Regulatory Technology (RegTech) and Supervisory Technology (SupTech) within the financial regulatory ecosystem. By synthesizing existing literature, the study identified the principal drivers and barriers influencing technology adoption and integrated them into a single framework that captures the interconnected relationship between commercial banks and central banks. The framework contributes to the literature by adopting an ecosystem perspective, highlighting that successful digital transformation depends on coordinated efforts by both regulators and regulated institutions.

The findings suggest that RegTech and SupTech adoption is encouraged by regulatory complexity, increasing data requirements, operational efficiency objectives, risk management needs, and technological advancement, while legacy systems, data-related challenges,

implementation costs, skills shortages, governance concerns, and organizational resistance continue to impede implementation. Understanding the interaction between these enabling and constraining factors can assist policymakers and financial institutions in developing more effective digital transformation strategies.

Based on the proposed framework, supervisory authorities should encourage regulatory environments that support innovation, interoperability, and secure data exchange, while financial institutions should strengthen technological infrastructure, data governance, and workforce capabilities to improve the successful implementation of RegTech solutions. Greater collaboration between regulators and regulated institutions will be essential for achieving sustainable digital transformation across the financial regulatory ecosystem.

This study is conceptual in nature and has not empirically validated the proposed framework. Future research should test the framework across different regulatory environments using quantitative or qualitative approaches and examine how institutional and technological differences influence RegTech and SupTech adoption.

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